Space Weather Technical Forecast

Issued on Wednesday, 16 November 2022 at 12:05 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares (Minor to Moderate radio blackouts) throughout. Slight chance of S1 (Minor) Radiation Storms and X-class flares (Strong radio blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been at Low levels, with often frequent but low level C-class flare activity, mostly originating from AR3140 (Ekc/Beta-Gamma).

There are three other numbered regions currently on the visible disc. The other moderately large region is located just south of the most active region mentioned above, AR3141 (Es0/Beta) but has been largely inactive. The other regions are small and simple. Two further un-numbered spot groups have recently appeared near the southeast limb.

No significant Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1 by DSCOVR, has been slow-ambient between 350-400 km/s. Density has been at near to below average levels. The total magnetic field strength (IMF) has been weak throughout remaining below 6 nT. The north-south component, Bz, has fluctuated weakly between +5/-4 nT. Phi angle remained negative (towards the Sun). Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at background to moderate levels, with a peak of 414 pfu at 15/1700 UTC. Electron fluence levels remained well below Active (1e8 integrated pfu) levels, with a very slight rising trend. Observed fluence at 16/00000 UTC was 6.01e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be generally Low, with a chance of M-class flares, and a slight chance of isolated X-flares, most likely from AR3140.

Solar Wind / Geomagnetic Activity: No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible from a weak glancing passage, late on 17 Nov or during 18 Nov.

Solar winds are currently at slow-ambient levels. A further enhancement is possible from weak coronal hole influence during Day 1 (16 Nov) from two small coronal holes. Geomagnetic activity is forecast to be predominantly Quiet through much of the coming 4-day period. However, there is a chance of Unsettled intervals, and perhaps a slight chance of an isolated Active interval should any HSS effects manifest, or if there are any weak CME related enhancements either late on Day 2 (17 Nov) or through the course of Day 3 (18 Nov).

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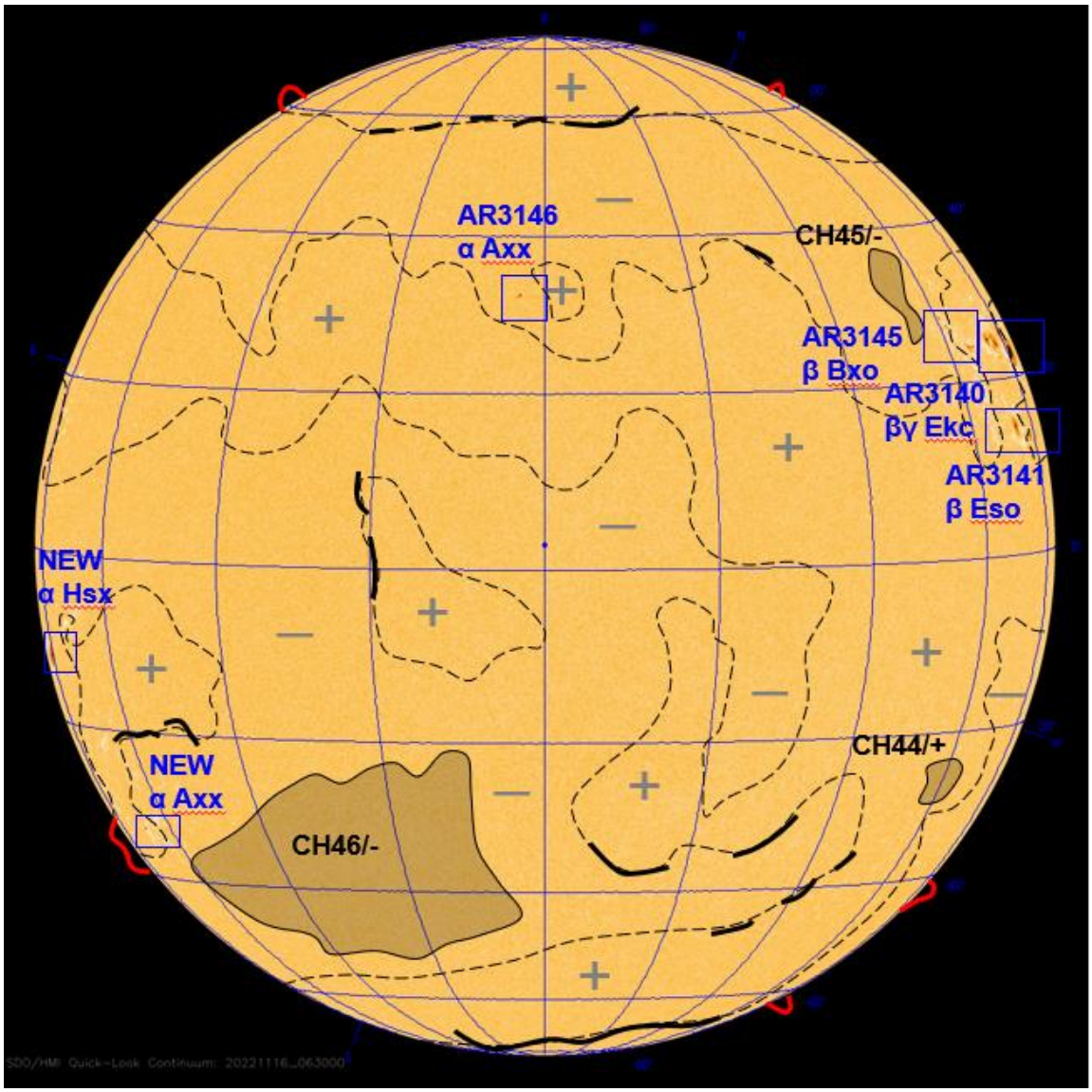
Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is most likely to remain at background levels throughout. However, there is a slight chance of a solar radiation storm from AR3140 and AR3141 in the far northwest. Electron flux is forecast to remain at mostly background to moderate levels throughout the period. Moderate or perhaps briefly High electron flux is possible at diurnal maxima from Day 2 (17 Nov) onward, but with low confidence. Fluence values are expected to remain below or well below the Active (1e8 integrated pfu) threshold throughout the period.

Figure 1. Solar Analysis Valid 16/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No significant Earth-directed CMEs are expected during the period, although some minor CME effects are possible. Two filament lift-offs were observed on the 13 Nov and 14 Nov, and these are predicted to pass ahead of Earth's orbit, but could give a weak glancing blow either late on 17 Nov, or more likely, during 18 Nov. Significant impacts are unlikely if encountered at Earth. Solar winds are currently at slow-ambient levels. A further enhancement is possible from weak coronal hole influence during Day 1 (16 Nov) from two small coronal holes. Geomagnetic activity is forecast to be predominantly Quiet through much of the coming 4-day period. However, there is a chance of Unsettled intervals, and perhaps a slight chance of an isolated Active interval should any HSS effects manifest, or if there are any weak CME related enhancements either late on Day 2 (17 Nov) or through the course of Day 3 (18 Nov).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Radio Blackouts - X-Ray Flares:

Solar activity is expected to remain at Low levels throughout the period. There is a chance of isolated M-class flares during the period and a slight chance of isolated X-flares, most likely from AR3140.

There are currently four numbered solar regions on the visible disc. AR3140 approaching the northwest limb is the largest and most complex region, classified Ekc/Beta-Gamma. AR3141 situated a little further south has been re-classed Eso/Beta, as two penumbra are clearly present. AR3145 again in the northwest, has shown some spreading but little overall development. AR3146 in the north, approaching centre disc, has decayed to a small unipolar spot. Two new regions have been added, one for a couple of weak spots emerging toward the southeast limb, the other a returning moderately sized uni-polar spot.

AR3140 and AR3141 are expected to fully rotate off the visible disc on Day 2 (17 Nov) and Day 3 (18 Nov) respectively, although they could still pose some risk, albeit diminishing, of flaring beyond the western limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	45	40	30	10
Very Active	R3 to R5 X Class	No	10	10	5	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, as observed by GOES-16, is currently at background levels and is most likely to remain at this level throughout the period. However, the presence of AR3140 and AR3141 toward the northwest limb will continue to pose an enhanced risk of proton storms over background conditions, and this is reflected in the probabilities given in the table.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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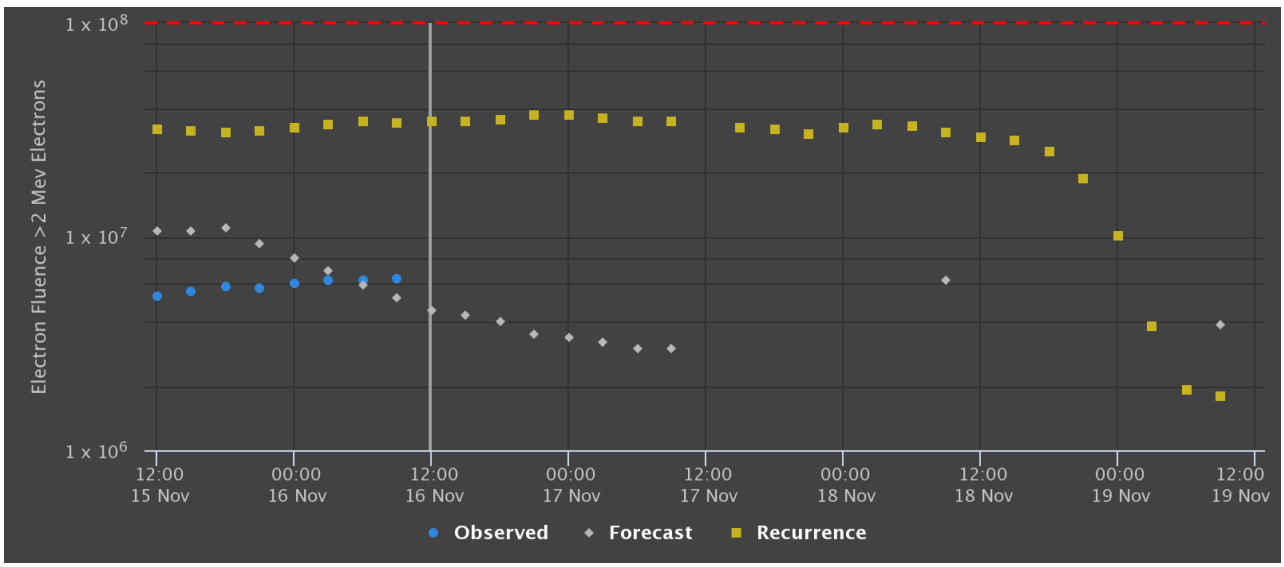
High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) is currently at mostly background levels and is forecast to be at background to moderate levels through much of the coming 4-day period. The possible weak HSS influences from two coronal holes is most likely during Day 1 (16 Nov), although significant charging is considered unlikely from these features. Moderate or perhaps briefly High electron flux is possible at the diurnal maxima from Day 2 (17 Nov) onwards, though with low confidence. Persistently high levels are considered very unlikely.

Electron fluence values are well below the Active (1e8 integrated pfu) threshold and are expected to remain so throughout the period, with a slight rising trend possible from Day 3 (17 Nov). The MOSWOC REFM output currently supports electron fluence values remaining below the Active threshold with a mostly flat trend indicated which offers good guidance. Fluence levels on the last rotation remained below the Active threshold with slightly faster wind speeds, and a similar trend is considered to be a probable outcome.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REFM output.



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